

Fig. 5. View of a nearly completed specimen; the regenerated anterior portion, consisting of the head and the œsophageal region of the digestive chamber, is recognized by its pallor: *b*, cephalic fissure. Magnified under a lens.

Observations on the Septum of the Cæcidæ; and some remarks on the subject of the suppression of the Genera *Brochina* and *Strebloceras* or *Phleboceras*. By the Marquis LÉOPOLD DE FOLIN. Communicated by W. BAIRD, M.D., F.R.S., F.L.S., &c.

(PLATE VIII.)

[Read June 18, 1868.]

THE importance of the septum, or that part of the shell, in the Cæcidæ, whose function is to close the tube when a portion of it has become useless and been abandoned, has been considered very great. But whilst recognizing the value, as a diagnostic specific character, of the restored apex, I am, nevertheless, of opinion that it should be employed with circumspection in the case of specimens distinguished from each other only by slight differences in this respect. I have observed such imperceptible gradations between two septa apparently most widely distinct, that, it appears to me, but very doubtful reliance can be placed on the character presented by that part of the shell, and that it is always necessary to guard against our being deceived by certain abnormalities in form which occasionally affect its value.

It is possible that by paying some attention to the mode in which the obliteration is effected (by which is meant the mode of formation of the septum), we may obtain some aid in support of this opinion, or which may afford the means of explaining it.

It appears evident that the production of an apex to the new shell, as yet incompletely formed, commences by a circular suture on the inner wall of the tube. The plane in which this circumferential suture lies will be termed the "plane of obliteration;" and we may remark at starting that a section which would separate the older from the new shell would lie most frequently in this plane. We will now speak of the desertion of the shell when it has become insufficient for its inhabitant.

It is clear that in attempting to account for the manner in which the mollusk proceeds in the construction of this septum

(upon which it will soon have to support itself), it is indispensable to regard the animal as already established beyond the chosen point, in order there to trace out the plane of obliteration (A B, fig. 1). From that moment the portion A B C D will remain empty and useless up to the time of decollation. The first layer will be deposited at the points a & b , and the process of formation will be continued in the planes $c d$, $c' d'$, $c'' d''$, &c., all parallel to the plane A B. But as this is accompanied with a continual narrowing of the space to be filled up, eventually the wall $a c c' c'' s d'' d' d b$ is formed, which terminates at the summit or apex s ; and this constitutes the outer layer of the septum. With respect to the thickening of that part, we may consider it certain that it is accomplished after the closure has been completed.

It should be observed that in the cases in which the septum assumes the form $a s b$, fig. 2, and which it presents in several remarkable species, the process must be effected from s to e , and from e to e' before it is finished at $c f d$, the portion $a s b$ being always occupied, and the point of insertion of the muscle f being always placed pretty near the "plane of obliteration." We may also remark that the thickness always increases as the septum approaches the axis, and that it is greatest on the imaginary line proceeding from the apex from s to s' , fig. 1. But this can only be effected by the superposition of concentric layers of constantly diminishing diameters, and whose borders a, b, c, d, e, f , fig. 3, are further and further remote from the walls of the tube, A B C D.

From the preceding remarks it would follow: (1), that whatever may be the character of the septum, and consequently its external form, the interior part does not correspond with this form; (2), that the septum always constitutes a firm dissepiment, upon which a site for the muscular impression is reserved. Nevertheless, in the species furnished with mammillated or hemispherical septa, the internal surface is slightly concave.

Mr. Phillip Carpenter, in his Monograph of the Cæcidæ, expresses the opinion that the septum is perhaps an integral part of the shell, which advances from time to time by additional layers. That eminent author bases his hypothesis on the following fact. A specimen of *Brochina glabra* seemed to be deprived of a septum; having been broken accidentally, the cicatrix was visible at the end of one of the fragments. Such a position seemed abnormal, and appeared to justify the supposition above cited. Neverthe-

less it is by no means extraordinary and can be very easily explained. The fracture was not in the "plane of obliteration," but a little above it; and an instance of this sort cannot surprise us, seeing that I have had occasion to observe several species in which the mucronate or dactyliform septum, which is sometimes very much elongated and attenuated, and consequently fragile, appears to require protection. The persistence of a part of the primitive shell, sufficient to conceal the septum, furnishes such a safeguard. In the instance noticed by Mr. Carpenter, the cause of the condition was not the same; and we can see in it simply an example of accidental fracture of the apex of the shell of the second stage at a time when that of the third stage was still incomplete, or before the proper period for decollation had arrived. But it is not by such an explanation of the circumstance that I shall contest the hypothesis advanced by Mr. Carpenter. I would also remark that, if due attention be paid to the foregoing observations regarding the formation of the septum, they will tend to show that, in order to render a translation of that part possible, we must first admit that it has been preceded by a solution of the primary apex. In fact we meet with shells of the second stage provided with a septum perfectly united to the walls of the tube, quite complete, and certainly produced by an original process of obliteration. Lastly, with respect to this point, I am in a condition to affirm, from specimens in my possession (some in the first stage, others in the first and second united, and some exhibiting all three stages in the same shell), that all have the spiral apex perfect and entire, and which has not been displaced, never having lost its original position. Moreover, I have never observed a septum belonging to the after stages of the shell presenting the slightest appearance of spirality. We are thus in a position to conclude that if the mollusk could move without having any support for the extremity of its muscle from the primary apex to the second, it may well be able also to transport itself from the first portion of the second shell to that of the third. This first process towards obliteration may invariably be noticed existing in every shell of the second stage; and if it were destined to be displaced in order to close a subsequent portion, it would not be always found in the same position, that is to say, closing the summit of the second shell.

Moreover, if we admit the possibility of a translation taking place, it might be asked how such translation is effected. We

would observe that the diameter of the tube is greater at the point to which the septum has to be transferred; and it is impossible to conceive of such a proceeding except on the supposition of a slow movement, in consequence of which the septum advances little by little. But, in this case, specimens would be commonly met with in which the translation was in progress, a circumstance that would be very readily witnessed. Nevertheless, we can assert that no specimen of a shell of Cæcidæ has ever come under our notice in which the slightest evidence of such a proceeding has been apparent, although we have examined many thousands. If it is said that it is only at distant periods and at the time of change of shell that the translation takes place, we should be still wholly unable to comprehend the mechanical operation by which it is accomplished, which would demand such great perfection in the movement by which the septum was displaced in order that it should be brought correctly into the "plane of obliteration," perpendicular to the axis, and with the apex invariably situated at the same point near the right side of the shell. In a perfectly smooth tube, how could the animal, without any *point d'appui*, perform such a transference, demanding rigidity and precision in order to obtain always identical results? Such a thing appears to us impossible, and we should have rejected the supposition, simply relying upon the arguments already adduced, and which appear to us amply sufficient to disprove it, if a positive proof in the same direction had not presented itself against the opinion of Mr. Carpenter. We have lately received from New Providence (Bahamas) some specimens of a new species of *Cæcum*, *C. formosulum*, amongst which is a complete shell of the third stage still attached to that of the second. Having glued it on a piece of glass in order to examine it, and some time afterwards having moistened it for the purpose of transferring it to another glass, for which I employed a very delicate pair of forceps, my double *Cæcum* broke in two under the pressure of the instrument. It was a clean fracture in the "plane of obliteration," and with a perfectly straight circumference. On the glass tablet were now two shells, each furnished with a septum. That of the adult shell was remarkable in its having undergone no apparent abrasion. Consequently, the two septa were placed one on the adolescent and the other on the shell of the third stage, although but a moment before they had both appertained to the same shell. We think that an instance

of this kind affords the best possible proof that the septum is not susceptible of translation. We have carefully preserved the double *Cæcum* in two portions, together with specimens of another species from the same locality, and which also exhibit the adolescent and adult shells still united.

Subjoined are the diagnoses of the two species in question:—

In conclusion, we find the septum invariably formed in the interior, and thus preserved from any chance of irregularity. But it should also be remarked that a structure of this kind, in its destination, is not necessarily subject to laws originating in immutable and inflexible forms under necessities of capacity, and that under similar conditions the septum, without entirely losing its character, may differ in size (*taille*), and undergo slight alterations of form in different specimens of the same species.

CÆCUM FORMULOSUM. (Plate VIII. fig. 4.)

Testa parum conica, satis arcuata, aurantiaca, interdum alba, zonulata, nitida, longitudinaliter costis validis rotundis et strigis satis regularibus ornata, transversim annulis crebris, planatis, paulo rotundatis, primum angustis, dein crescentibus, postea majoribus decussata, aperturam versus haud tumida; apertura vix declivi, haud contracta, nec marginata; septo primum lævigatè mamillato; apice submucronato; margine laterali subrecto, paulo concavo, interdum primum convexo dein concavè; operculo . . . ?

Long. 0·0028, diam. 0·0005–0·0007.

Hab. New Providence, Bahama.

CÆCUM DECUSSATUM. (Pl. VIII. fig. 5.)

Testa vix conica, satis arcuata, solida, aurantiaca seu albida, crystallina, interdum subopaca, nitida, costis validis, rotundatis, et strigis minutis longitudinaliter ornata, transversim irregulariter striata, ad basim tumida, tumore rotundato, aperturam versus annulis validis rotundis decussata; apertura paulo declivi, parum contracta, leviter marginata; septo minimo, submucronato; apice subdextrorso; operculo . . . ?

Long. $\left\{ \begin{array}{l} 0\cdot0022, \\ 0\cdot003, \end{array} \right.$ diam. $\left\{ \begin{array}{l} 0\cdot0006. \\ 0\cdot0007. \end{array} \right.$

Hab. New Providence, Bahama.

Remarks on the genera Brochina and Strebloceras or Phleboceras.

The authority of the learned author who created the genus *Brochina* is so high that it is with hesitation that I venture to express some doubt as to its existence. As the convexity of

the operculum is in reality the only distinctive character of *Brochina*, it is important to inquire whether such a character is sufficient, and whether it is peculiar to a class of shells susceptible of constituting a genus. At present the number of species appears to be reduced to a single one. This is very little; and I have remarked in various specimens belonging to this species such an affinity with shells diverging widely from the diagnosis of the genus, that I have been led to entertain doubts on the subject.

In January 1867, I published, in the 'Journal de Conchyliologie,' two new species of *Brochina*, *B. Someri* and *B. achi-rona*, differing from each other only in the form and size of the septum. The specimens came from Brazil, and appeared in all respects to accord with the generic diagnosis—aperture acute and operculum convex in the centre, flat at the margin, and very thick, so as actually to appear convex. I accordingly placed the shells under the genus *Brochina*. Some time afterwards we received other samples of the sea-bottom from the same anchorage, and in the sand were found other specimens of the same species, amongst which some appeared to be marked with a longitudinal ornamentation; and I soon discovered that some of them were distinguished by a set of strong and wide longitudinal *striæ*, which in others appeared gradually to diminish in distinctness, until at last they entirely disappeared in the smooth shells. This showed at once that there was no longer any question of these shells not belonging to the genus *Brochina*, and that the shells first referred to were smooth forms of *Cæcum*, of which there existed a variety—*striata*. This circumstance having awakened my suspicions respecting the genus, I endeavoured to collect a great number of specimens of *Brochina glabra*, and to examine the specific characters in many individuals. I sent for specimens from England and examined them carefully. They did not seem to correspond exactly with Dr. Gray's diagnosis. When the shell was full-grown and complete, I remarked that the aperture was not acute, but, on the contrary, surrounded by a narrow reflected border, of whose existence we were assured by observing an almost insensible enlargement (*enflure*) near the base by the narrowing of which the aperture was contracted, at the end of which contraction was a very minute groove, beyond which rose the reflected border above referred to.

Numerous specimens of *Brochina glabra* from sand dredged at Belleisle and the Bay of Biscay, representing a variety (*minima*) of the species, and which are extremely transparent, resembling the purest crystal, exhibit the same reflected border, but without any appearance of tumefaction.

The results of several dredgings on the coast of Syria and in the Mediterranean have furnished further specimens in the same condition. From what has been stated, we may conclude that the character of the genus is reduced to this,—that the shell is smooth, and that the septum is mammillated, points common to the other Cæcidæ. Nothing remains, then, as a distinctive character but the convexity of the operculum. But is this a point of sufficient importance to separate shells provided with such an operculum from genera under which they might be ranged for several reasons equally valid with those by which it is sought to exclude them? Is our knowledge of the operculum in the Cæcidæ so satisfactory as to allow us to regard its convexity as a certain distinctive character? We do not think that it is, and what we have established with regard to *B. Someri* and *B. Acherina* proves that there may be some reason for the doubt.

Shells occur very closely approaching *Brochina glabra*, but which I think it is impossible should belong to that species. I have distinguished a whole series of such Cæcidæ presenting such differences from each other as to justify us in establishing several species. The form which most nearly resembles *B. glabra* differs from that species so slightly, and the general characters are so much alike in the whole series, the two species differing only in certain points, that I have deemed it possible to regard the first of these species as the simplest of the series, and the connecting link with *B. glabra*. Amongst these forms are several furnished with a tumefaction, which is sometimes annular, and which, if regarded as an ornamentation, does away with the character of smoothness; and we may consequently regard these shells as belonging to the genus *Cæcum*, which consequently is found to be closely allied to *Brochina*.

The following are the diagnoses of the new species above referred to:—

1. CÆCUM INFIMUM (published in 'Les fonds de la Mer'). Pl. VIII. fig. 2.

Testa (quoad genus) minuta, cylindrica, arcuata, tenui, subtranslucida,